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ABSTRACT

This study investigated the advantages and disadvantages of different forms of drills as used in computer assisted instruction (CAI) lessons in phonetic transcription. Subjects (N=44) were students in a course in general phonetics at the University of Illinois. Measurements of student learning, student attitude, and time required for completion were considered for drills constructed with and without specific rehearsal of items initially missed. Time spent by students in exploratory and quiz sections of the lessons was also recorded. Results affirm that programming lessons to train the students by providing extra practice on their problem areas is educationally sound, and indicate that the extra time involved in the lesson design is worthwhile in terms of student learning and attitude. (Author/VT)

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The Effects of Drill Structure on Learning in Phonetics Lessons

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ABSTRACT

This study is undertaken to investigate the advantages and disadvantages of different forms of drills as used in CAI lessons in phonetic transcription. Measurements of student learning, student attitude and time required for completion are considered for drills constructed 1) with and 2) without specific rehearsal of items initially missed. Time spent by students in exploratory and quiz sections of the lessons is also recorded. Recommendations are made for other similar applications.

BACKGROUND

PLATO lessons in the teaching of phonetics have been used at the University of Illinois and elsewhere for over four years. Students typically begin the course in general phonetics with one lesson which serves both to familiarize students with the study of the symbols of the International Phonetic Alphabet (IPA) used for the transcription of English and to acquaint them with interacting with PLATO in a simple drill format.

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Next, concurrently with lectures about the nature of speech sounds, they use the set of lessons in transcription (primarily drill and practice), with which this study is concerned. For the next several weeks, these lessons replace regularly scheduled laboratory practice sections in transcription. They require students to type the phonetic symbols representing the particular sounds which are presented to them by means of an EIS random-access audio device in conjunction with a PLATO terminal.

At other appropriate points later in the course, additional drill, simulation and game lessons are provided as a supplement to lecture and laboratory sessions.

METHOD

For this study, two forms of the transcription lessons were constructed. Both took advantage of natural groupings of the sounds. (Consonants were presented first, those with symbols which closely resemble letters being followed by eight with less familiar or less intuitive symbols. Ten common pure vowels were studied next, followed by a group of ten common diphthongs.) For each group of new sounds, a period of exploratory study came first; students heard the sounds while being presented with the respective symbols, and could ask PLATO to repeat an individual sound or the entire sequence. When ready, they proceeded to a drill on the sounds under study. Return to the exploratory section was available from the drill. Students were required to master each group before going on to the next, but could review previous groups at any time.

In one version (A) of the drill, each item was selected at random from the pool of items under study. Students worked from that pool until they had successfully identified twelve of the last fourteen consecutive sounds on their first attempt. No special attention, other than providing diagnostic feedback and requiring the correct response before continuing, was given to items missed.

In the other version (B), students worked through the same set of items ordered randomly, then were required to repeat any items that were confused until these were correctly identified on initial presentation. Sounds that the student transcribed incorrectly, as well as the stimulus sound on which errors were made, were restored to the pool of items retained for further rehearsal. The student was required to continue practice within the set until he/she missed fewer than two items on the first try.

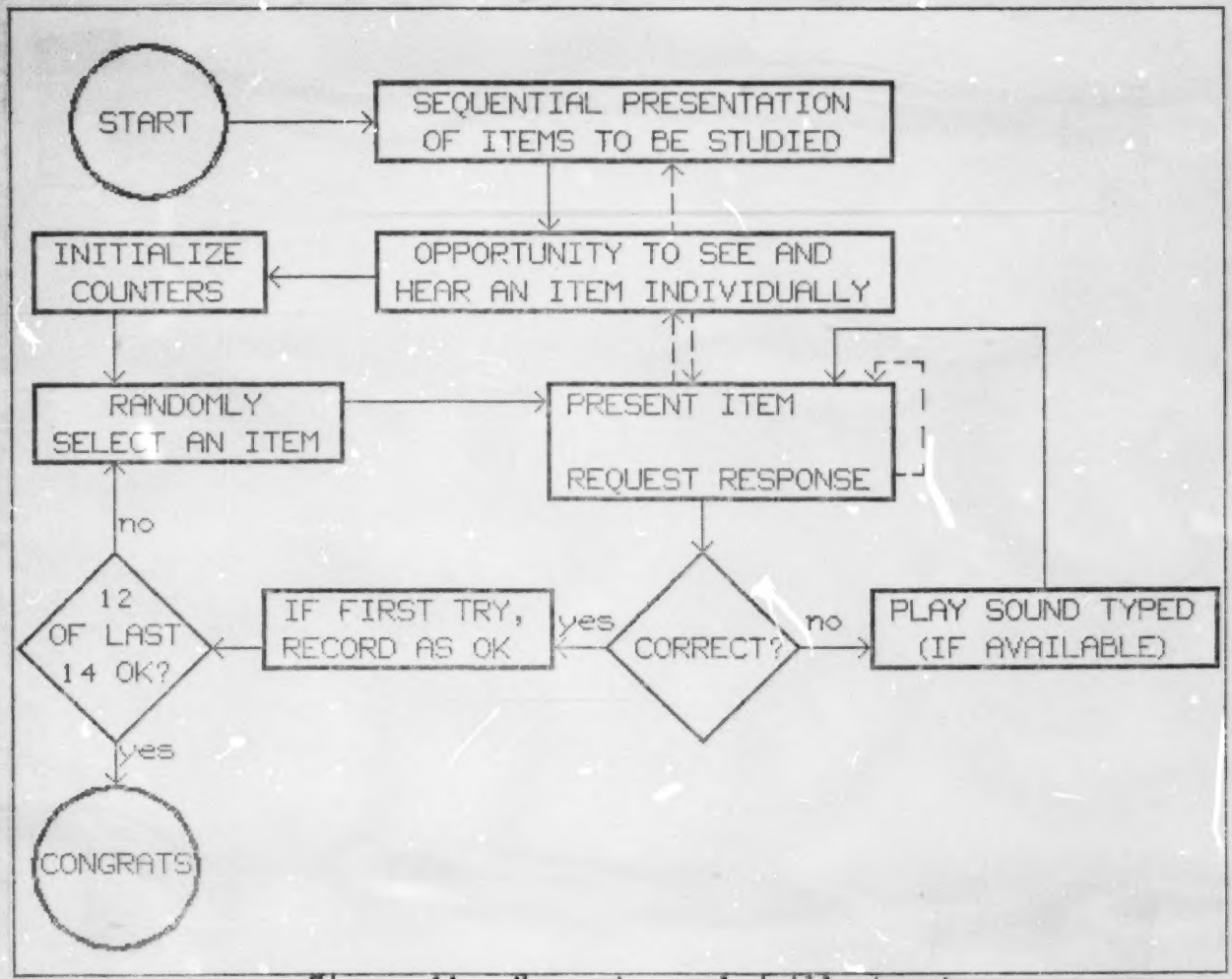

Figure 1A. Non-rehearsal drill structure

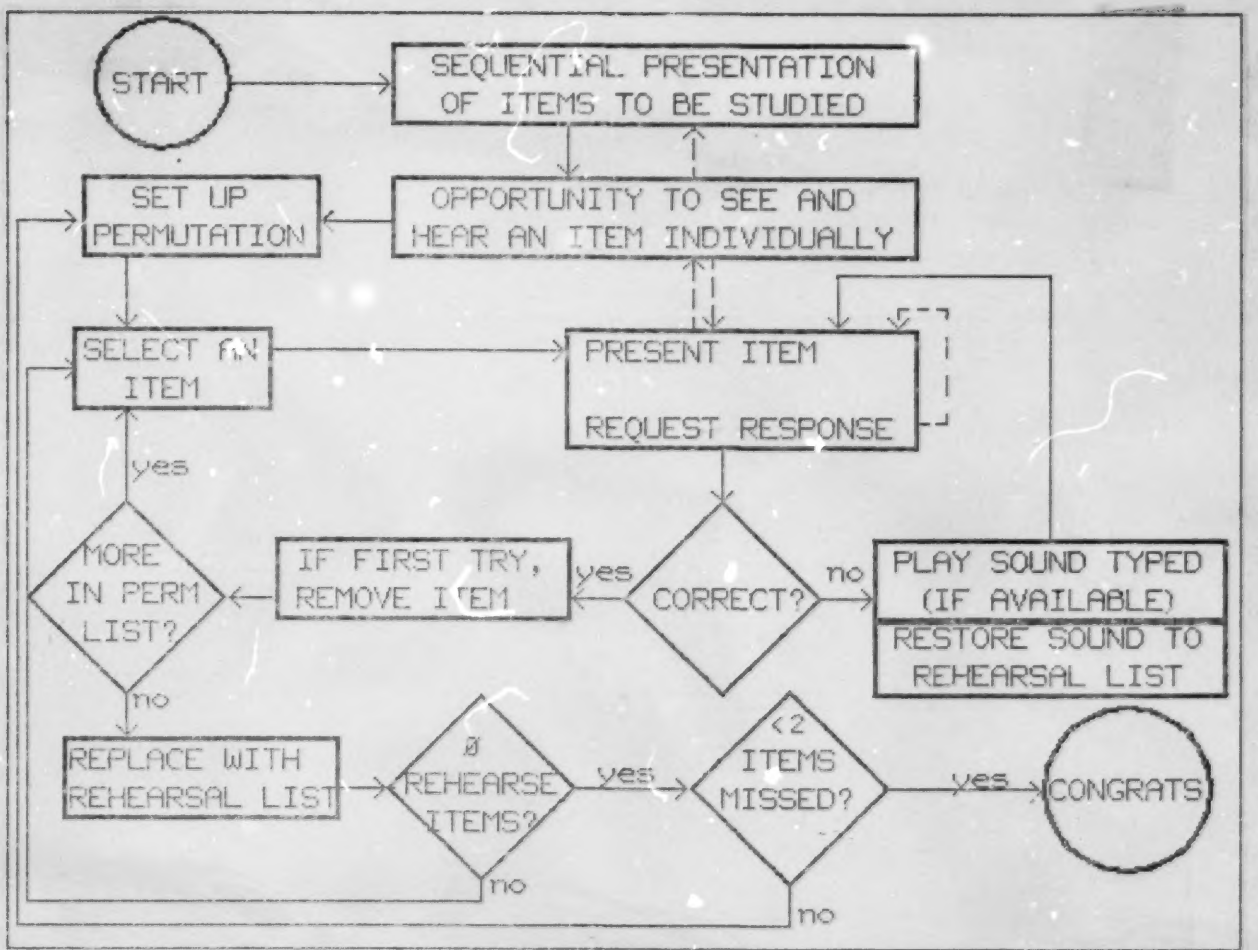

Figure 1B. Rehearsal drill structure

Schematic diagrams of a sample structure for one group of sounds as studied within each version are shown in Figure 1.

Subjects were the students in SPSHS 301, a course in general phonetics at the University of Illinois, Urbana. Enrollment was fairly evenly distributed among juniors through graduate students, and the course was a requirement for about three quarters of the students, because of academic major.

Preliminary data were collected on 18 students during the spring semester of 1977, during which half of the class saw a rehearsal and half saw a non-rehearsal form of the lesson. During this run, rehearsal was limited to only the stimuli which were incorrectly identified, rather than restoring the incorrect sounds typed for them to the rehearsal list as well. The groups were matched on the basis of previous background in phonetics, attitude toward PLATO instruction based either on previous experience or hearsay, and academic major. Results of the study were assessed by an off-line quiz in transcription and an informal attitude survey given to both groups after students had completed the lessons.

Additional data were collected on 26 students during the fall semester of 1977. In addition to studying achievement differences between students who studied different versions of the lessons as structured in Figure 1, we took a survey on student attitudes both before and after working through the lessons. How much time the students spent in the exploratory and quiz sections of the lessons was also recorded.

Proficiency in transcription was measured at the conclusion of the three weeks during which the lessons had been completed by administering an off-line audiotaped dictation test, which both groups took concurrently. The test was evaluated by a grader who had no knowledge of which students were in which groups.

Attitudes toward PLATO instruction were assessed by asking students to respond to the statements, "PLATO is a useful mode of instruction," and "PLATO is an enjoyable way to learn," by indicating either strongly unfavorable, unfavorable, no opinion, favorable, or strongly favorable. The attitude test was administered immediately after the students had taken the dictation test.

Data on performance were evaluated by t-tests. Attitude data were analyzed by ranks, considering the responses to

each question to contain at least ordinal information. Data on time spent were examined for relevant correlations with attitude and performance measurements both between groups and within groups.

RESULTS

Data from the preliminary study indicated that students using the form of the lesson with rehearsal (even rehearsal without restoration of incorrectly typed sounds to the rehearsal list) were significantly ($p<.05$) better at transcription, though both had learned the material adequately. Results of an informal attitude study in the preliminary test yielded no significant differences between the groups; all were on the neutral to positive side.

Again in the fall study, both groups seemed to master the material presented. The number of errors on the transcription quiz ranged from 0 to 7.5. Within group A, the mean number of errors was 4.46, and the standard deviation was 1.82. Within group B, the mean number of errors was 2.81, and the standard deviation was 2.19. The difference between groups was significant ($p=.047$).

Students' attitudes toward using PLATO were generally favorable, slightly more being favorable after they had completed the lessons than before. Asked a general question about whether, given a choice, they would choose to use PLATO in the course for learning basic, essential skills, rather than doing so in small quiz sections, 17 of 26 said they'd choose PLATO at the beginning of the course. (Five from group A and four from group B would prefer quiz sections.) A few students shifted within each group for a final small change to 21 of 26 choosing PLATO. (Three from group A and two from group B opted for quiz sections.) Thus, the choice of drill structure was not shown to be a significant factor in influencing decisions on whether PLATO should be used.

Student opinions on whether PLATO is useful as a mode of instruction are summarized in Table 1. Both groups were slightly favorable to PLATO initially, and both improved by the conclusion of the study. Among possible comparisons, however, only the change from before to after within group B was found to be significant at the $p<.05$ level. Though a pro-PLATO shift was observed and found significant, results as to whether group differences exist are inconclusive.

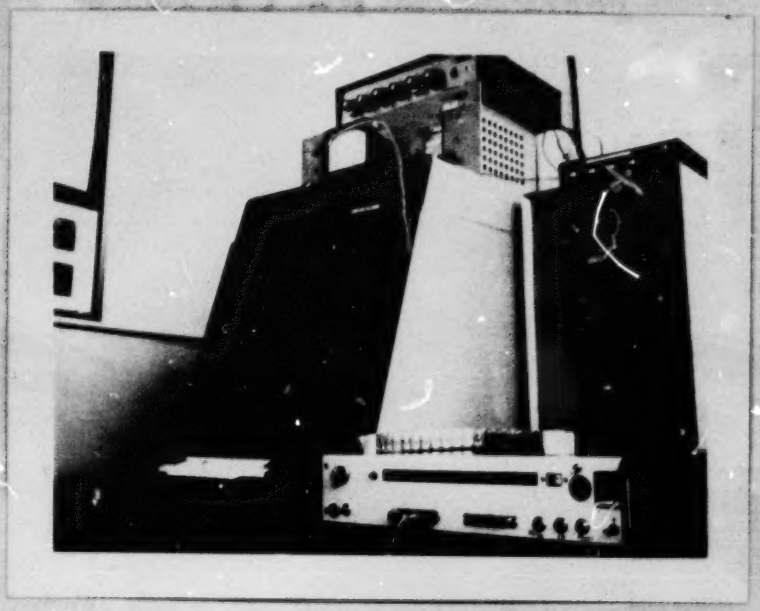

FIGURE 3

A laboratory version of the sensory aid, designed to complement the PLATO system, is shown in the lower right. The tactile belt, with its row of electrocutaneous stimulators, is worn around the abdomen; the tactile patterns corresponding to spoken words are associated with pictures of common objects, as presented on the touch-sensitive visual display.

Group	Before lessons					After lessons				
	SU	U	-	F	SF	SU	U	-	F	SF
A	0	1	3	7	2	0	0	0	6	7
B	0	1	5	3	4	0	0	0	1	12

Table 1. Comparison of attitudes toward usefulness of PLATO: number of respondents in each category.

Similar results occurred on whether PLATO was thought to be an enjoyable way to learn. Table 2 shows a summary of students' responses. Again, the shift was generally and significantly favorable to PLATO, the only individual comparison reaching significance ($p<.05$) being group B, before and after. It can be concluded that these students were favorable toward PLATO as an enjoyable way to learn, and were more strongly so after completing these lessons.

Group	Before lessons					After lessons				
	SU	U	-	F	SF	SU	U	-	F	SF
A	0	1	6	4	2	0	1	2	8	2
B	0	2	5	5	1	0	0	1	3	9

Table 2. Comparison of attitudes toward whether PLATO is an enjoyable way to learn: number of respondents in each category.

On the average, people in group B took longer to complete the lesson portions under study, as shown in Table 3. Partially because of the wide spread in both groups, however, the difference was not significant. Students spent about 18% of their time in the self-directed exploratory sections of the lessons.

Group	Exploratory	Quiz
A	6.3 / 3.3	35.7 / 22.9
B	9.7 / 8.5	50.1 / 29.9

Table 3. Means / standard deviations of times in minutes spent in exploratory and quiz sections of the lessons.

No substantial correlation was found among achievement scores, time spent and student attitude within either group. A difference in approaches was noted from student to student in frequency of exercising the option to return to the exploratory section for review. Some students, on reaching the quiz, elected to stay there until PLATO moved them on; others reviewed their choices as many as seven times within one set of items. Again, however, this difference in approach did not correlate with achievement scores.

CONCLUSION

This study affirms that programming lessons to train the students by providing extra practice on their problem areas is educationally sound, and indicates that the extra time involved in the lesson design is worthwhile in terms of student learning and attitude. Further evidence of the value of such constructs in CAI languages is thus provided. Other questions remain open for further study, e.g., whether rehearsal of incorrectly typed items is important to include as well as the stimulus for which they were typed.

In addition, we have begun to gain a better understanding of the strategies of sophisticated learners in an environment allowing a learner-controlled mix of self-directed practice and drill.

The study itself provides an example of a benefit of linked users in a CAI network. Designed, programmed and analyzed at the University of Delaware, the study's administration took place entirely at the University of Illinois. Without such a common workbench as was provided by the PLATO system and its varied communication schemes, it could not have been executed.

Finally, we have demonstrated that there is much to be learned by studying instructional variations within CAI materials. In addition to the important tasks of validating lessons and comparing instructional media, we hope that users of CAI will continue to take advantage of the flexibility of the computer for the study of the many options available to lesson designers and programmers, viewing our system as perhaps the most powerful educational research tool ever developed.

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